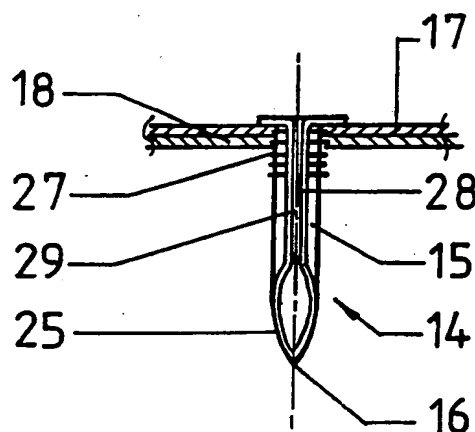


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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification 5 :</b> <b>F16B 15/00, 15/06</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 92/03664</b> <b>(43) International Publication Date:</b> <b>5 March 1992 (05.03.92)</b>
<b>(21) International Application Number:</b> PCT/AU91/00364 <b>(22) International Filing Date:</b> 15 August 1991 (15.08.91) <b>(30) Priority data:</b> PK 1732 15 August 1990 (15.08.90) AU <b>(71) Applicant (for all designated States except US):</b> AVANTECH PTY LIMITED [AU/AU]; 6 Mary Parade, Rydalmere, NSW 2116 (AU). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only) :</b> MEYER, Dolph, Allan [AU/AU]; 69 Jenkins Road, Carlingford, NSW 2118 (AU). <b>(74) Agent:</b> F.B. RICE & CO.; 28A Montague Street, Balmain, NSW 2041 (AU).		<b>(81) Designated States:</b> AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.  <b>Published</b> <i>With international search report.</i>

**(54) Title:** FASTENER**(57) Abstract**

A fastener (14), particularly adapted for use with sheet metal members, comprising an elongated body (15) terminating at one end in a sharp leading end (16) adapted to aid in penetrating sheet metal members. The body (15) is formed with a head (22) at its other end and with a resiliently compressible gripping portion (24) intermediate its ends. The cross sectional area (26) of the fastener (14) adjacent the leading end (16) is smaller than its cross sectional area in the gripping portion (24). The gripping portion (24) may be formed with corrugations (27) on its external surface. The fastener (14) can be driven through sheet metal members and the compressed gripping portion (24) will resiliently grip the metal surrounding the hole formed by the leading edge (16) to hold the fastener (14) in the sheet metal member.

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+ Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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FastenerField of the Invention

The present invention relates to fasteners which are particularly adapted to engage metal members of relatively thin section, such as metal frame members employed in buildings.

Background Art

Generally in domestic and industrial buildings where metal frames are employed, threaded fasteners are used to secure sheet material to the frame members, as well as securing individual frame members together. Relative to other fastening items such as rivets, threaded fasteners are time consuming to insert. Accordingly in constructing a building, if threaded fasteners are to be employed, the cost of the structure is increased considerably. Still further, threaded fasteners do not lend themselves for use in rapid insertion apparatus such as nail guns.

Conventional nails cannot be employed with steel frames since once inserted, the nail can come loose and therefore fail. When a standard solid metal fastener enters sheet steel it causes a size for size hole and has little or no retention.

The present invention is directed to a fastener which provides an alternative to known fasteners and is particularly adapted for engagement with metal members of relatively thin section.

The present invention consists in a fastener having an elongated body with at least one sharp leading end and a resiliently compressible gripping portion intermediate the ends of the fastener, the cross sectional area of the fastener adjacent the leading end or ends being smaller than its cross sectional area in at least a part of the gripping portion.

Fasteners according to the present invention can be driven through thin section metal members because of their

sharp leading end. The fasteners are particularly useful with sheet steel members such as steel wall framing having a thickness of up to 1.5mm, they are, however, also useful for connection to materials of greater thickness including steel up to about 4 mm. The cross sectional area of the fastener in the region of the sharp leading end is however smaller than that of the gripping portion. Thus the hole created in the metal member by the leading end will cause the gripping portion to be resiliently compressed as it passes into the hole made by the leading end of the fastener. The resilience of the gripping portion of the fastener will cause it to firmly engage the edge of the hole in the metal member and hold the fastener in position in it.

In a particularly preferred embodiment of the invention the fastener is provided with a head at the end of the fastener distal to its leading end. In another embodiment the fastener may not have a head but may be capable of being formed with a head such as by being threaded externally to enable a nut to be screwed onto the fastener.

The fastener is in a preferred embodiment substantially tubular and formed up from a sheet of spring steel or a similar material. The tube may be of generally circular, square, triangular or any other suitable cross sectional shape. Preferably the fastener has a C-shaped cross section at least in the region of the gripping portion. In this embodiment the natural resilience of the spring steel or like material combined with the C-shaped cross section will provide the gripping portion with its resilience and compressibility. In this form of the invention the tube tapers slightly towards the leading end of the fastener and is also chamfered to form a sharp leading end.

In an alternative embodiment of the invention the

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- fastener has two arms joined either at the leading end or the trailing end of the fastener or both. In this embodiment the arms are resiliently compressible towards one another and form the gripping portion of the
- 5 fastener. In either case the cross sectional area of the leading end of the fastener or the area between the leading ends of the fastener is smaller than its cross sectional area in the region of the arms which form the gripping portion.
- 10 The sharp leading end of the fastener may either be formed with a point or a sharp leading edge to assist penetration of the fastener into a substrate while the fasteners according to the present invention are perceived as being particularly suitable for use with thin section
- 15 metal members they may also be used with other substrates such as plaster board, wood, rubber, plastic and the like. In particular they are useful for connecting such materials to thin section metal members. The nature of the leading end of the fastener will depend to some extent
- 20 on the nature of the substrate into which it is to be driven. It has, however, been found that to be successfully driven into sheet steel the fastener should preferably have a hardness, at least in the region of its leading end, of 40 to 54 on the Rockwell C scale. High
- 25 carbon steels and spring steels provide suitable hardness. In order to provide a suitably sharp leading edge a substantially tubular fastener is preferably chamfered off at an included angle of less than 45°, preferably from 12° to 30°.
- 30 In a preferred embodiment of the invention the fastener may be provided with external surface roughening in the region of the gripping portion. This surface roughening preferably comprises a plurality of corrugations extending substantially at right angles to
- 35 the longitudinal axis of the fastener.

Brief Description of the Drawings:-

Figure 1 is a side elevational view of a fastener according to the present invention;

Figure 2 is a front elevational view of the fastener  
5 of Figure 1;

Figure 3 is a cross sectional view along III-III through the gripping portion of the fastener of Figure 1;

Figures 3a and 3b are cross sectional views similar to that of Figure 3 through alternative embodiments of the  
10 invention;

Figure 4 is a sectional view through two sheet metal members joined together by the fastener of Figure 1;

Figure 5 is a sectional view through a sheet of plasterboard and a sheet metal member joined by a fastener  
15 according to another embodiment of the present invention;

Figure 6 is a perspective view of a fastener according to another embodiment of the present invention;

Figure 7A is a perspective view of a punched strip of steel from which fasteners according to Figure 6 may be  
20 formed;

Figure 7B is a perspective view of a further punched strip of steel from which fasteners according to Figure 6 may be formed;

Figure 8 is a side elevational view of a fastener  
25 according to another embodiment of the present invention;

Figure 9 is a vertical sectional view along IX-IX of Figure 8;

Figure 10 is a front elevational view of a fastener according to another embodiment of the present invention;

Figure 11 is a side elevational view of the fastener  
30 of Figure 10;

Figure 12 is a front elevational view of a fastener according to another embodiment of the present invention;

Figure 13 is a side elevational view of the fastener  
35 of Figure 12;

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Figure 14 is a front elevational view of a fastener according to another embodiment of the present invention;

Figure 15 is a side elevational view of the fastener of Figure 14;

5        Figure 16 is a front elevational view of a fastener according to another embodiment of the present invention; and

Figure 17 is a side elevational view of the fastener according to Figure 16.

10    Best Method of Carrying Out the Present Invention

Referring to Figures 1, 2, 3, 4 and 5 the fastener (14) has an elongated metal body (15) which terminates at one end with a sharp leading edge (16) adapted to aid in penetrating the sheet metal members (17) and (18) in Figure 4 and the plasterboard sheet and sheet metal member (20) in Figure 5.

The longitudinal axis (21) of the body (15) extends generally through the head (22) of the fastener. However the edge (16) is laterally displaced from the axis (21).  
20    In this particular embodiment, the body (15) is of a tubular configuration with a slit (23) in the tube extending the full length of the body (15).

A resiliently compressible gripping portion (24) extends generally normal from the head (22) to the face (25) which extends at an acute angle to the head (22) down to the edge (16). The diameter (26) of the tube reduces in a slightly tapering cone down to the leading edge (16), starting at plane (30).

Corrugations (27) are formed on the external surface of the gripping portion (24). These corrugations (24) may be located anywhere on the body (15) from the head (22) to plane (30).  
30

The use of the above described fastener (14) may be for many applications two examples of which are shown in  
35    Figures 4 and 5.

In Figure 4 the fastener (14) is driven through sheet metal members (17) and (18) due to the sharp leading edge (16) being displaced laterally from the longitudinal axis (21) which causes the waste material of the hole being  
5 formed to be sheared by face (25) leaving a relatively undistorted hole.

During the penetration there is a force exerted on the body (15) from the sheet metal members (17) and (18) to close the faces (28) and (29) of the body (15). This  
10 results in a spring action which counters opening force from the body (15) locking the corrugations (27) to the sheet metal members (17) and (18). In Figure 5 the same metal fastener is illustrated showing a locking of the corrugations (27) to sheet metal members (20) and to some  
15 degree plasterboard sheet (19).

With reference to Figures 6 to 7B the fastener (14) of Figure 6 is similar to that of Figure 1 and similar parts will be given the same numeric designation. The fastener (14) may be rolled up from spring steel or high  
20 carbon steel strip (32). The strips (32) of Figures 7A and 7B may be parted along the dotted lines (33) and rolled up as shown by the curved arrows (34). In each case the head 22 may be formed before or after the rolling operation.

25 The fasteners of Figures 8 to 17 all involve a pair of arms forming the gripping portion. Similar parts will be given the same numeric designation in the description of these embodiments of the invention. As seen in Figures 8 and 9 the fastener (40) includes an elongated body (41) bearing a head (42) at one end and a sharp leading end  
30 (43) at the other. The body (41) is formed with a gripping portion (44) intermediate its ends. This gripping portion (44) is formed by the body (41) itself and an arm (45) punched out of the body (41) and tapering  
35 away from it. Both the body (41) and the arm (45) are



provided with transverse corrugations (46) on their external surfaces.

In the embodiment of Figures 10 and 11 two arms (47) and (48) are joined at the sharp leading end (43) of the fastener (40) and are each formed on their outer edges with corrugations (46). The arms (47) and (48) together constitute the resiliently compressible gripping portion (44). In the arrangement of Figures 12 and 13 the arms (47) and (48) are joined by a common head (42). Each arm (47) and (48) is formed with a sharp leading end (43) and the arms together constitute the resiliently compressible gripping portion (44). The area defined between the leading ends (43) is smaller than the area defined between the gripping portion (44) such that when the fastener 40 is hammered into a sheet metal member the gripping portion (44) will be resiliently compressed as the arms (47) and (48) enter the holes made by the leading ends (43). The corrugations (46) will then bear resiliently against the side edges of the holes and hold the fastener in place in the sheet metal member.

The fastener (40) of Figures 14 and 15 is formed of sheet material and again has two arms (47) and (48) joined by a leading end portion (43). Figures 16 and 17 show a further embodiment of a fastener (40) in which the arms (47) and (48) are joined both at the leading end (43) and at the head (42). In each case the arms (47) and (48) are, in use, compressed together upon entering a hole in a sheet metal or other member made by the sharp leading end (43) upon the fastener (40) being driven into the member.

It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as

illustrative and not restrictive.

## CLAIMS:-

1. A fastener having an elongated body with at least one sharp leading end and a resiliently compressible gripping portion intermediate the ends of the fastener, the cross sectional area of the fastener adjacent the leading end or ends being smaller than its cross sectional area in at least a part of the gripping portion.
2. A fastener as claimed in Claim 1 in which the fastener is provided with a head at the end of the fastener distal to the leading end.
3. A fastener as claimed in Claim 1 in which the fastener is, at its end distal to the leading end capable of being formed with a head.
4. A fastener as claimed in Claim 1 in which the fastener is substantially tubular at least in the gripping portion.
5. A fastener as claimed in Claim 4 in which the gripping portion is of C-shaped cross section.
6. A fastener as claimed in Claim 1 in which the fastener is formed from spring steel or from a high carbon steel.
7. A fastener as claimed in Claim 6 in which at least the leading end of the fastener has a hardness of from 40 to 54 on the Rockwell C Scale.
8. A fastener as claimed in Claim 1 in which the gripping portion is formed by two arms forming part of the fastener and which are joined together at the leading end or the other end of the fastener or both.
9. A fastener as claimed in Claim 1 in which the fastener is provided with external surface roughening in the region of the gripping portion.
10. A fastener as claimed in Claim 9 in which the surface roughening comprises a plurality of corrugations extending substantially at right angles to the longitudinal axis of the fastener.

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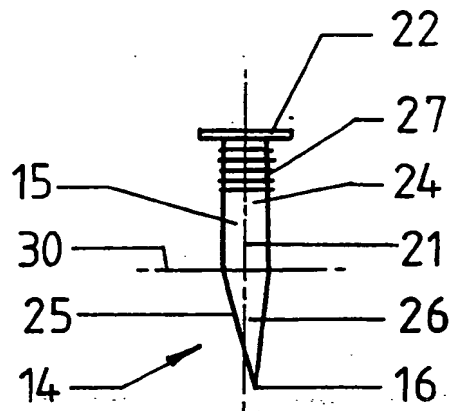


Fig. 1

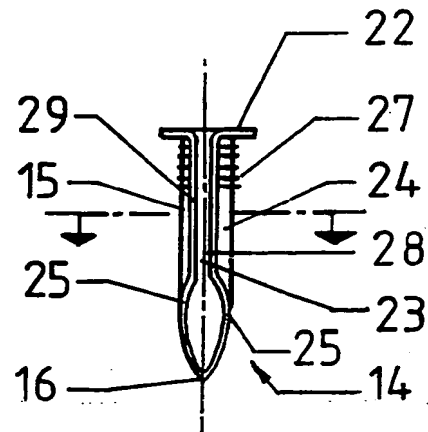


Fig. 2

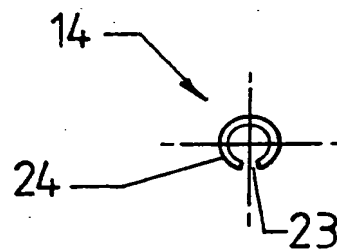


Fig. 3

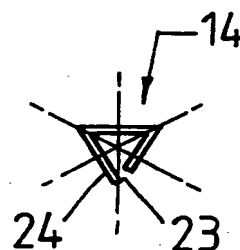


Fig. 3a

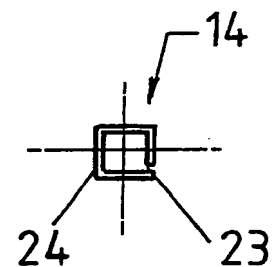


Fig. 3b

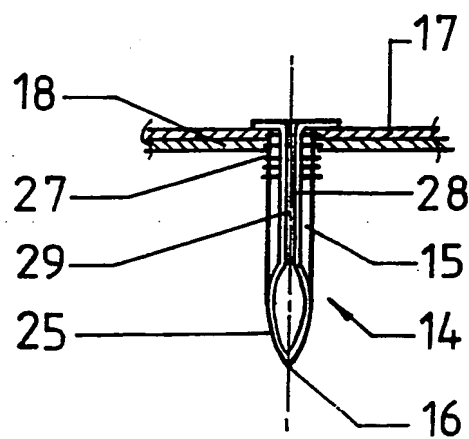


Fig. 4

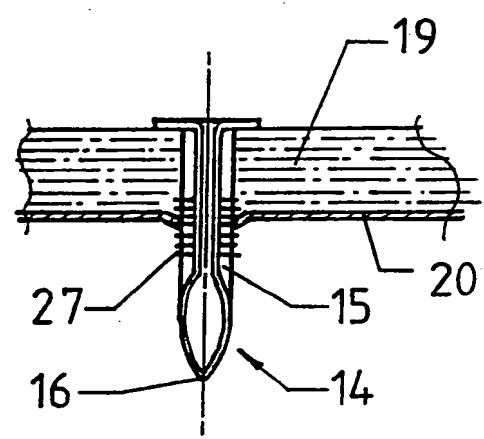


Fig. 5

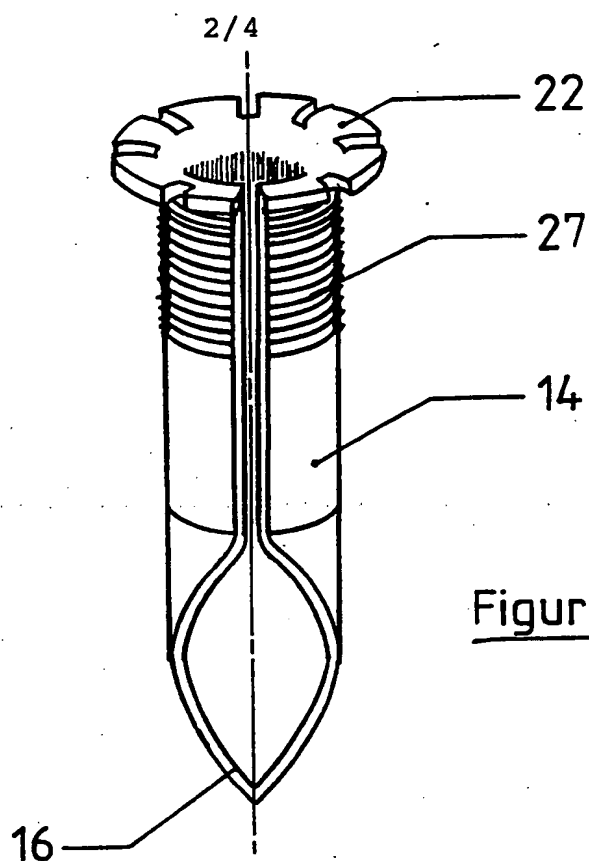


Figure 6

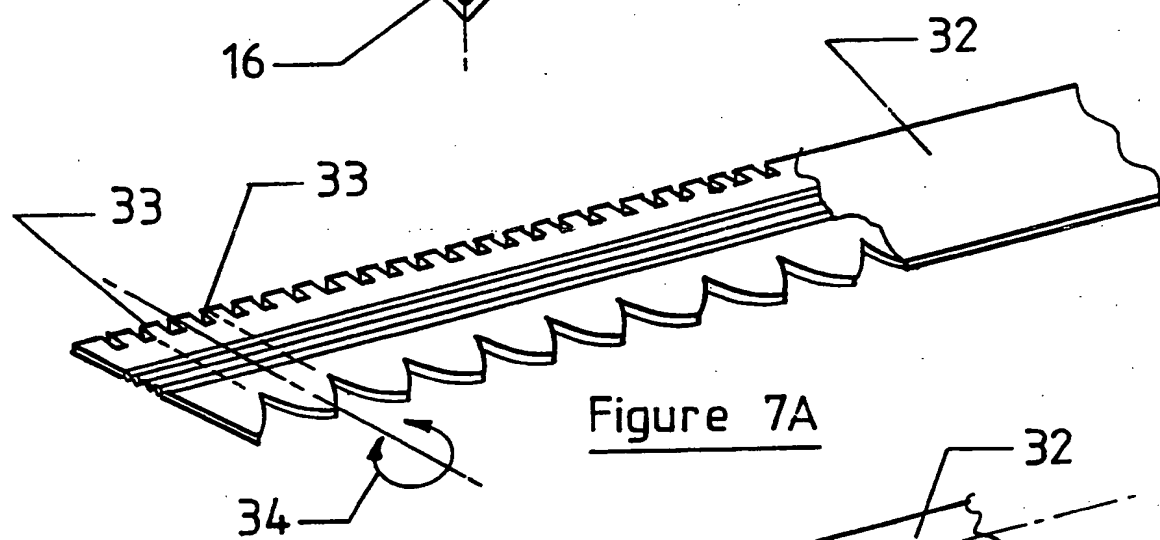


Figure 7A

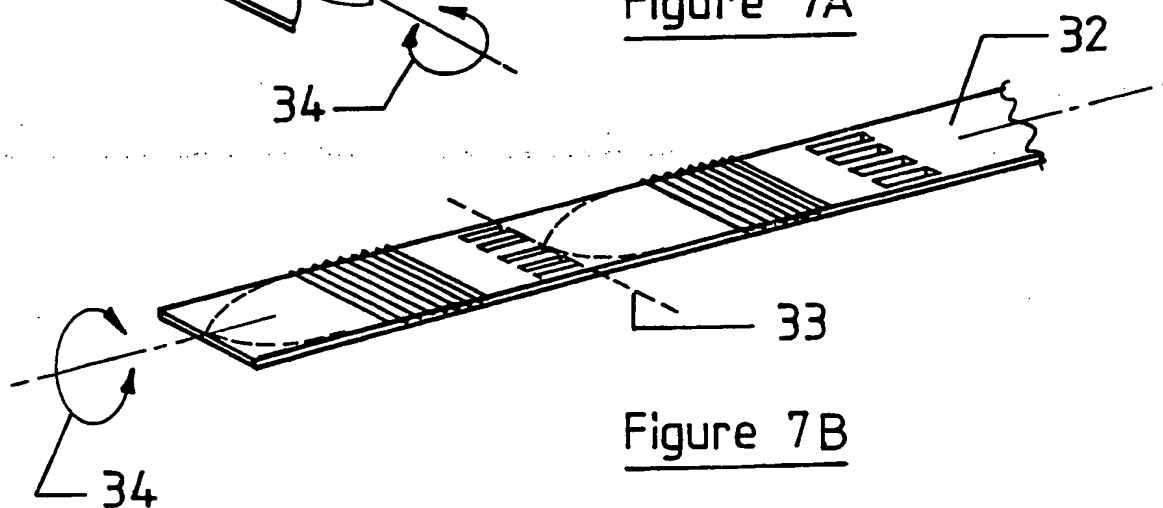


Figure 7B

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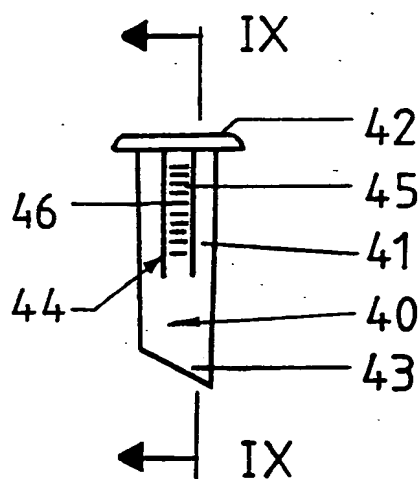


Fig. 8

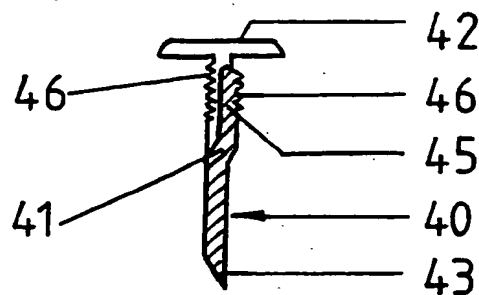


Fig. 9

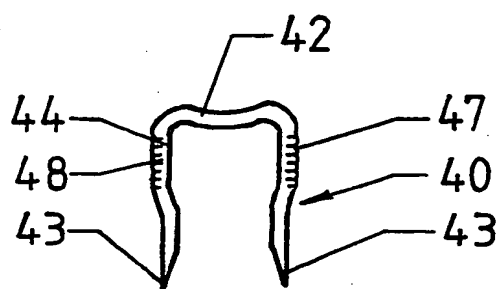


Fig. 12

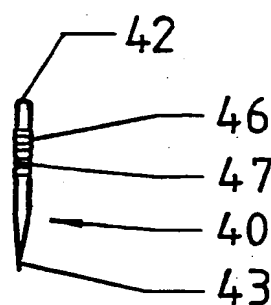


Fig. 13

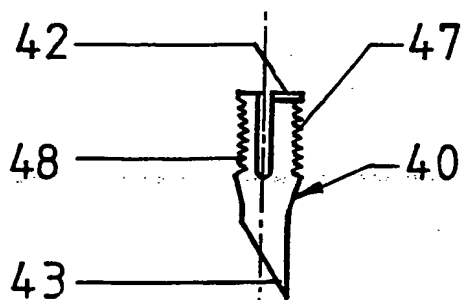


Fig 14

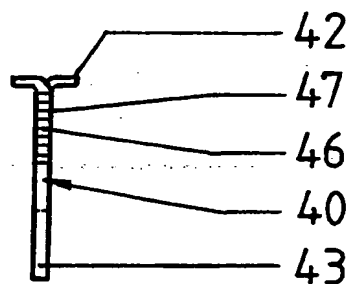


Fig. 15

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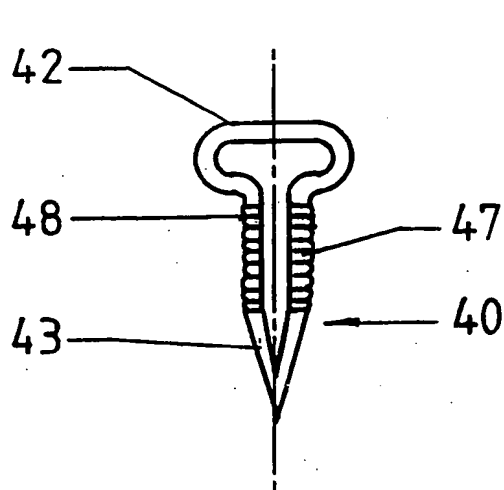


Fig. 16

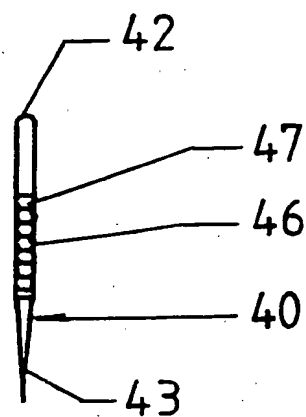


Fig. 17

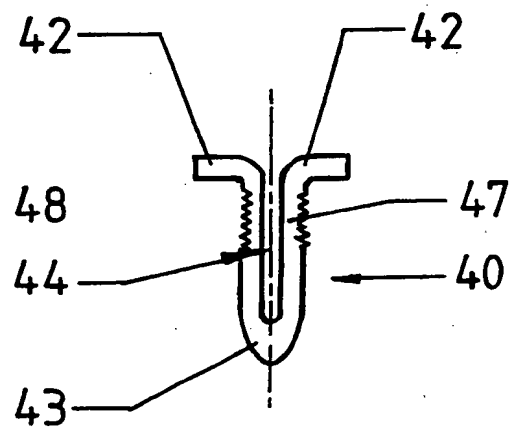


Fig. 10

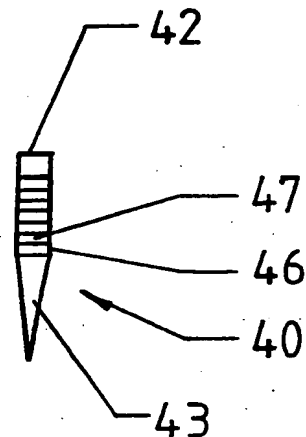


Fig. 11

# INTERNATIONAL SEARCH REPORT

## I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)<sup>6</sup>

According to International Patent classification (IPC) or to both National Classification and IPC  
Int. Cl.<sup>8</sup> F16B 15/00, 15/06

## II. FIELDS SEARCHED

Minimum Documentation Searched <sup>7</sup>

Classification System

Classification Symbols

IPC

F16B 15/00, 15/06

Documentation Searched other than Minimum Documentation  
to the extent that such Documents are included in the Fields Searched <sup>8</sup>

AU : IPC as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup>

Category <sup>9</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate of the relevant passages <sup>12</sup>	Relevant to Claim No <sup>13</sup>
X	GB,A,1072609 (HILLEKE) 21 June 1967 (21.06.67) See whole document.	(1-10)
X	GB,A,1465896 (THE STEEL COMPANY OF CANADA LIMITED) 2 March 1977 (02.03.77) See entire document.	(1-10)
X	US,A,1697810 (COMSTOCK) 1 January 1929 (01.01.29) See the claims.	(1-10)
X	US,A,2093610 (KRAEMER) 21 September 1937 (21.09.37) See whole document.	(1-10)
(continued)		

\* Special categories of cited documents : <sup>10</sup>

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"E" earlier document but published on or after the international filing date  
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)  
"O" document referring to an oral disclosure, use, exhibition or other means  
"P" document published prior to the international filing date but later than the priority date claimed

"T" Later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step  
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art  
"&" document member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the International Search  
18 November 1991 (18.11.91)

Date of Mailing of this International Search Report

27 November 91

International Searching Authority

AUSTRALIAN PATENT OFFICE

Signature of Authorized Officer

*S.K. Ghosh*  
S.K.GHOSH



**III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)**

Category*	Citation of Document, <sup>11</sup> with indication, where appropriate of the relevant passages <sup>12</sup>	Relevant to Claim No <sup>13</sup>
X	US,A,3850073 (HAYES) 26 November 1974 (26.11.74) See whole document.	(1-10)
X	US,A,3874263 (BARTH ET. AL.) 1 April 1975 (01.04.75) See whole document.	(1-10)
X	US,A,3969975 (KROL) 20 July 1976 (20.07.76) See column 2 line 20 to column 3 line 61.	(1-10)
X	US,A,4354782 (NEWPORT) 19 October 1982 (19.10.82) See claims 1-8 and the drawings.	(1-10)
X	DE,A,3735570 (ROCKENFELLER KG) 3 May 1989 (03.05.89) See whole document.	(1-10)

**ANNEX TO THE INTERNATIONAL SEARCH REPORT ON  
INTERNATIONAL APPLICATION NO. PCT/AU 91/00364**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
GB	1465896	CA	1014383		
US	3850073				
US	3874263	AT	1730/73	AU	52491/73
		BR	7301440		
		CA	969009	DE	2309266
		FR	2174606		
		NL	7302810	US	3800653
		ZA	7301110		
US	3969975	CA	1040906		
US	4354782				
DE	3735570				

END OF ANNEX